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# *Xenopus pygmaeus,* a new diploid pipid frog from rain forest of equatorial Africa

by

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With 5 figures

## Abstract

*Xenopus pygmaeus* sp. nov., a new diploid species of clawed toad, is described from Northern Zaïre and the Lobaye River in Central African Republic; it is sympatric with *X. muelleri, X. andrei* and *X. epitropicalis.*

Small size, tiny eyes, dorsal pattern and mating calls distinguish it within the *Xenopus fraseri* group.

## Introduction

Thirteen species are currently recognized in the genus *Xenopus.* Of those species, seven belong to the *X. fraseri* group having in common an additional fourth claw on the metatarsal tubercle, large eyelids and long tentacles. Members are *X. amieti, X. andrei, X. boumbaensis, X. ruwenzoriensis, X. vestitus, X. wittei* and *X. fraseri* (Tinsley 1975; Fischberg & Kobel 1978; Tinsley *et al.* 1979; Kobel *et al.* 1980; Loumont 1983). All are polyploid excepted the diploid *X. fraseri.*

The possible existence of undescribed species was predicted by Loumont (1984). A recent field survey in the rain forests of southern Central African Republic confirmed this and led to the description of a new species in the *X. fraseri* species group.

## Material and methods

The description is based on 35 live specimens collected by myself during the mentionned field survey in April (end of the dry season) and in July (continuous rains) and now housed in the Laboratory of Genetics of the Geneva University and the Museum

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d'Histoire naturelle (MHNG) of Geneva. Preserved specimens, all from northern Zaïre are in the collections of the American Museum of Natural History, New York (AMNH) and the Museum of Comparative Zoology, Cambridge (MCZ).

For recordings of mating calls I used live specimens from Buta (Zaïre) collected by C. Thiébaud in 1982, and donated to the Laboratory of Biology of the Geneva University. The recordings of calls of males from Buta were made in the Laboratory with Brüal & Kjaer 8001 hydrophone under the same conditions of those I made previously (Vigny 1979). The calls of males from Bouchia were made in the air, the hydrophone being unavailable.

The following method of calculating the volume of erythrocyte nuclei indicates quickly the ploidy of a specimen without killing it (H. R. Kobel): dilute a drop of blood with Ringer's solution, draw the cells and measure the three half axes (a.b.c) of several nuclei. Volume = $4/3 \times a \times b \times c$. The erythrocytes of all 35 specimens have been examined and compared simultaneously with the erythrocytes of sympatric species: *X. muelleri, X. andrei* and *X. epitropicalis.*

Methods of measurement follow those described by Tinsley (1973).

## **Xenopus pygmaeus** sp. nov.

(Figs 1-5; Tables 1-2)

### *Holotype*

MHNG 2196/4, an adult male collected on April 1984. The type locality is Bouchia (3°45'N, 18°10'E), 450 m, approx. 40 km Southeast of M'Baiki, Central African Republic.

### *Paratypes*

34 paratypes (still alive) collected in the three swamps of the lower basin of the Lobaye river: 2♂, 1♀, 1 juvenile taken with the holotype; 4♂, 4♀ from Bagandou (3°45'N, 17°50'E), 540 m; 8♂, 12♀, 2 juveniles from Etoi (3°40'N, 17°40'E), 420 m. Other specimens: 244 preserved specimens from northern Zaïre, Banalia (AMNH 9790), Niapu (AMNH 9749-78), Ngayu (AMNH 9764-70), Avakubi (AMNH 9793-9801), Medje (AMNH 9736-65), Dungu (AMNH 9783-85) and Buta (MCZ 21629-31).

### *Diagnosis*

Separated from the other species of the *X. fraseri* group by a small size (♂ 34 mm SVL, ♀ 44 mm SVL), a dorsal pattern often consisting of two parallel or curved stripes behind the eyes (Figs 1-2), very small eyes, diameter 1.3-1.7 mm (X = 1.6), and a dark iris (Fig. 3).

### *Description of holotype*

A mature male 33 mm SVL. Eye diameter 1.5 mm. Width between the pupils 6.4 mm, 1.98% of body length. Subocular tentacles 0.8 mm long. Hind limbs (41 mm) more than body length (13.5%), fore limbs (16 mm) about half body length. Volume of erythrocytes nuclei $13.4 \times 10^{-8}$ mm$^3$.

Number of lateral line plaques around the eyes (9-10), between the eyes and the cloaca (16-17). Four claws.

Dorsal color in life brownish and legs reddish. A characteristic horseshoe-shaped pattern behind the eyes (Fig. 1-2A); posterior region mottled. Ventral color legs are grey and belly white without spots.

FIGURE 1.

Drawing of the dorsal pattern of *Xenopus pygmaeus* (MHNG 2196/4, male holotype, 33 mm SVL). Note the two curved stripes behind the eyes.

*Variation*

Measurements of all females and males from the three localities are listed in Table 1. Morphometric characters were taken only from living specimens in Central African Republic.

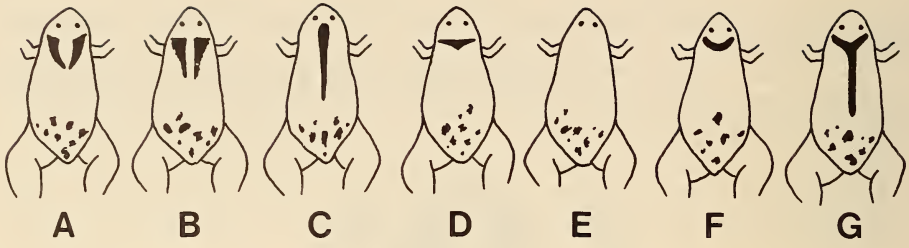


FIGURE 2.

Dorsal patterns of *Xenopus pygmaeus*. Parallel or curved stripes A and B, although distinctive, are not the most frequent morph.
Morphs A and B (6 specimens) and morphs C and D (7 specimens) come rather from Etoi and Bouchia; each locality have morph E (16 specimens);
6 specimens from Bagandou and Bouchia show morphs F and G.

The dorsal pattern is highly variable (Fig. 2) and several phenotypes are present at each locality: at Bouchia and Etoi all patterns were present, at Bagandou only the morph C-G; pattern E was the most frequent at Etoi and Bagandou. The back is brown or greenish, always mottled posteriorly; the legs are clear reddish brown.

Ventrally the legs are pale yellow and speckled with grey as is the venter.

*Mating calls*

The call of *X. pygmaeus* consists of a light crackling sound, phonetically; the frequency is lower in males from Bouchia than from Buta.

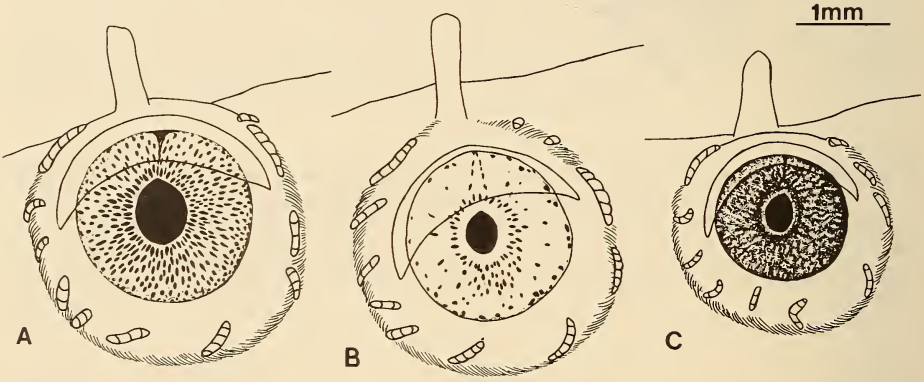


FIGURE 3.

Pigmentation of the iris of *Xenopus pygmaeus* (C), which is heavily pigmented, compared to that of *X. andrei* (A, specimens collected at Bouchia in July, B. in April).
Observations were made under controlled illuminations; seasonal variation is not explained.

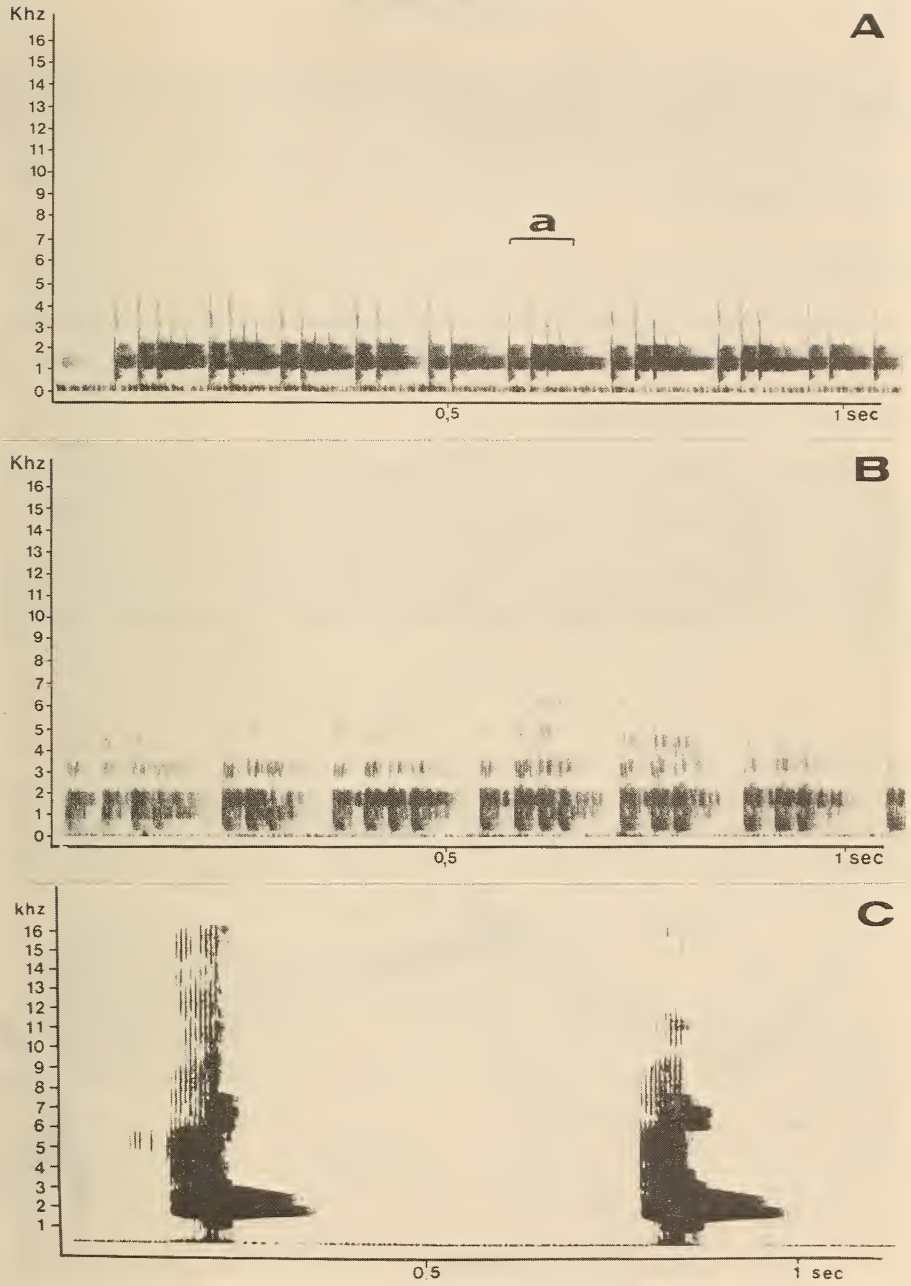


FIGURE 4.

Sonograms of the mating calls of *Xenopus pygmaeus* from (A) Buta, Zaïre and (B) Bouchia, Central African Republic, compared with unpublished calls of *Xenopus amieti* from (C) *Manengouba,* Cameroon. The length of one call (a) is indicated. Sonogram (B) were recorded in the air hence an echo lacks of the sharpness of the notes.

The calls are composed of short trills of four to five notes each (Table 2) and are repeated without interruption. One male uttered series of vocalisations comprising 15, 3, 21, 30, 7 and 38 calls labelled (a) on Fig. 3.

In males from Buta the first note is loud, well separated from the others, which accentued the bell-like tone.

*Etymology*

I propose the specific name *pygmaeus* for the species because of its small size and in recognition of the help of the Pygmy women in capturing specimens.

*Distribution and habitat conditions*

At present, *X. pygmaeus* is known only from the lower Lobaye River in southern Central African Republic and along the northern border of Zaïre (Fig. 5). In the swamps of Bouchia, *X. pygmaeus* lives in sympatry with *X. muelleri* (5 specimens), *X. andrei* (65 specimens) and *X. epitropicalis* (4 specimens). At the entry of the village, two shady swamps, about one meter deep, spread under bushs and tall trees. For fishing, the Pygmy women built mud dykes and small ponds between the shrubs, and drained the water into basins.

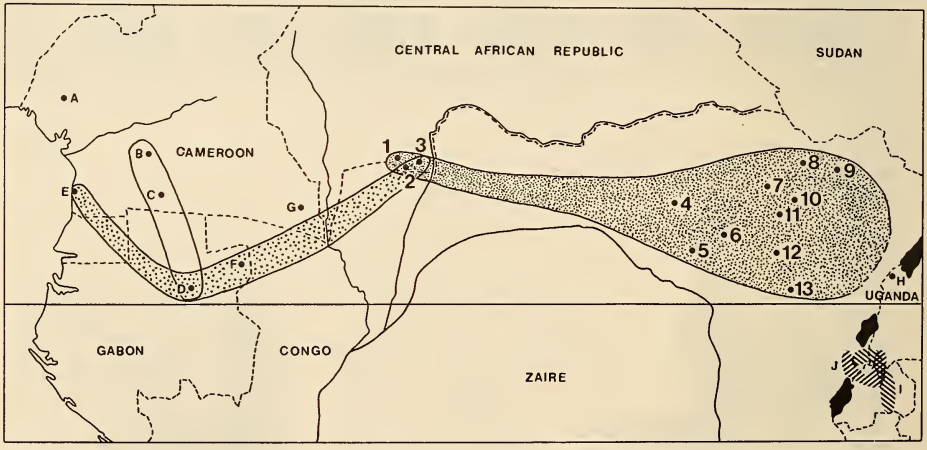


FIGURE 5.

Distribution of *Xenopus pygmaeus* in equatorial Africa: my records come from Bagandou (1), Etoi (2) and Bouchia (3); live specimens collected by C. THIÉBAUT from Buta (4); museum collections from Banalia (5), Niapu (6), Poko (7), Niangara (8), Dungu (9), Isiro (10), Medje (11), Ngayu (12) and Avakubi (13). Others species of the *X. fraseri* group:
*X. amieti* (A, Manengouba), *X. fraseri* (B, Yaoundé; C. Sangmelima; D, Makokou), *X. andrei* (E, Longyi; F, Mekambo), *X. boumbaensis* (G, Mawa), *X. ruwenzoriensis* (H, Semliki river), *X. vestitus* (I) and *X. wittei* (J).

TABLE 1.

Morphometric characters with standard deviation of *Xenopus pygmaeus* from the localities. Volume of diploid erythrocytes nuclei of *X. muelleri* ($11.7 \times 10^{-8}$ mm$^3$ ± 0.16), *X. laevis sudanensis* ($12 \times 10^{-8}$ mm$^3$ ± 0.25) and tetraploid nuclei of *X. andrei* ($26 \times 10^{-8}$ mm$^3$ ± 0.17).

| | *Mean dimensions (mm)* | | | | | |
|---|---|---|---|---|---|---|
| *Localities* | *Bouchia* | | *Bagandou* | | *Etoi* | |
| *Number of specimens* | 4♀ | 4♂ | 4♀ | 4♂ | 12♀ | 4♂ |
| Body length (SVL) | 39 ± 3.3 | 35.7 ± 6.1 | 31.7 ± 4.3 | 32.2 ± 0.9 | 33.7 ± 5.6 | 32 ± 1.2 |
| Eye diameter | 1.6 ± 0.08 | 1.55 ± 0.05 | 1.37 ± 0.05 | 1.4 ± 0.05 | 1.5 ± 0.12 | 1.5 ± 0.05 |
| Tentacle length | 1.0 ± 0.12 | 0.95 ± 0.1 | 0.97 ± 0.17 | 0.97 ± 0.09 | 0.97 ± 0.14 | 0.85 ± 0.08 |
| Number of lateral line plaques | | | | | | |
| a) around the eyes | 10.2 ± 0.5 | 10.6 ± 1.0 | 10.6 ± 1.3 | 11 ± 0.4 | 10.6 ± 0.7 | 11 ± 0.7 |
| b) between eye and cloaca | 17.1 ± 1.1 | 17.6 ± 1.3 | 17 ± 1.1 | 17.6 ± 1.7 | 17.5 ± 1.2 | 17.7 ± 1.08 |
| Ratios (% of body length) | | | | | | |
| a) eye diameter | 4.13 ± 0.4 | 4.4 ± 0.3 | 4.3 ± 0.45 | 4.5 ± 0.25 | 4.4 ± 0.4 | 5 ± 0.3 |
| b) distance between eyes center | 16.6 ± 0.4 | 17.7 ± 2.6 | 19.2 ± 1.0 | 18.6 ± 1.3 | 18 ± 1.1 | 18.7 ± 0.8 |
| c) tentacle length | 2.65 ± 0.45 | 2.7 ± 0.4 | 3.06 ± 0.3 | 3.0 ± 0.2 | 2.7 ± 0.5 | 2.6 ± 0.3 |
| Volume of erythrocytes nuclei ($\times 10^{-8}$ mm$^3$) | 13 ± 0.18 | | 10 ± 0.24 | | 11 ± 0.27 | |

TABLE 2.

Physical characteristics of the mating calls of *Xenopus pygmaeus*.

| *Localities* | *Buta* | *Bouchia* |
|---|---|---|
| Temp. °C | 25 | 20.4 |
| SVL of male | 30 | 32 |
| No. calls | 93 | 127 |
| Length of calls/s | | |
| Mean (range) | 0.11 (0.08-0.3) | 0.096 (0.02-0.26) |
| No. of calls/min | | |
| Mean (range) | 497 (400-600) | 350 |
| No. of notes/call | | |
| Mean (range) | 4.9 (3-8) | 4 (2-9) |
| No. of notes/min | | |
| Mean (range) | 2544 (2240-2920) | 2635 (2584-2680) |
| Fundamental | | |
| frequency (Khz) | 1.5 | 1.7 |

*Comparison with other species*

Within the *X. fraseri* species group, *X. pygmaeus* shares with *X. fraseri* the diploid genotype but differs phenotypically from it by the smaller body size, proportionally smaller eyes and by its mating calls.

Phenotypically the new species might be confused with *X. andrei,* but the latter has larger eyes, pale less pigmented iris (Fig. 5), and mating calls entirely distinct (LOUMONT 1983).

*X. epitopicalis,* a member of the tropicalis group, also have four claws and tiny eyes, but it differs strongly from *X. pygmaeus* by its pustular dorsal skin, reduced eyelids, and shorter tentacles.

The mating calls of *X. pygmaeus* is characterized by the presence of uninterrupted trills (like those of *X. gilli, X. laevis laevis* and *X. wittei*), low harmonics and fewer notes per minute, 2240 to 2920 (as in *X. muelleri, X. laevis laevis* and *X. wittei*). The sonagram of the new species, compared with that of *X. wittei,* an allopatric member of the *X. fraseri* species group, shows more notes per call (15.5 versus 4.9) and hence longer calls (0.43 sec. versus 0.11 sec.).

## DISCUSSION

It was surprising to collect in the same swamp of the rain forest of Bouchia, *X. pygmaeus, X. andrei* and *X. muelleri. X. muelleri* seems to be less confined to the savanna than has been claimed. Also present in Gabon, *X. andrei* extends now in equatorial West Africa.

There are two evolutionary clusters among the *X. fraseri* species group: two diploid species, *X. fraseri* in the west, from Yaoundé (Cameroon) to Makokou (Gabon), and *X. pygmaeus* to the east (Fig. 6). Tetraploidy appears to have occured around *X. fraseri,* with *X. andrei, X. boumbaensis* and *X. amieti* (LOUMONT 1984). In eastern Zaïre, *X. pygmaeus* is geographically near the other polyploid species, *X. ruwenzoriensis* (6n), *X. vestitus* (4n) and *X. wittei* (4n).

These two centers occupied by the two diploid species coincide with the glacial forest refugia of Cameroon/Gabon and of eastern Zaïre (DIAMOND & HAMILTON 1980). Does polyploidy represent the response of *Xenopus* to forest ecosystems oscillations?


## RÉSUMÉ

Une nouvelle espèce de *Xenopus* (Anura: Pipidae), *X. pygmaeus sp. nov.* est décrite. Par la présence d'un quatrième ongle et ses longs tentacules elle appartient au groupe *X. fraseri,* mais s'en sépare par sa petite taille, ses yeux minuscules, ses taches dorsales parallèles et ses trilles nuptiaux très courts mais rapprochés.

*Xenopus pygmaeus* est reconnue actuellement à la frontière nord du Zaïre et en basse Lobaye, au confluent de l'Oubangui, où elle est sympatrique avec *X. muelleri, X. andrei* et *X. epitropicalis.*

Entourés d'un grand nombre d'espèces polyploides, *X. pygmaeus* et *X. fraseri* sont les seules espèces diploïdes d'Afrique équatoriale.



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